CLASSIFICATION CONFIDENTIAL CONFIDENTIAL

CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT
CD NO.

50X1-HUM

COUNTRY USSR

DATE OF INFORMATION 1950

SUBJECT Transportation - Automobile, Gas fuel development

DATE DIST. 25 Oct 1950

HOW PUBLISHED Monthly periodical

WHERE PUBLISHED Moscow

NO. OF PAGES 4

DATE PUBLISHED Aug 1950

SUPPLEMENT TO REPORT NO.

LANGUAGE Russian

SOURCE Avtomobil', No 8, 1950.

UTILIZATION OF GAS AS AUTOMOBILE FUEL IN THE USSR

PRODUCTION OF GAS-POWERED AUTOMOBILES

Ye. A. Chudakov

The socialist character of the USSR economy guarantees the most efficient utilization of the power resources, including gas fuel, of the country for automobile transport. The replacement of gasoline by local gas-producing fuel in the large industrial and hard coal regions of the country is an important economic task.

Bottled gases are a good automobile fuel, surpassing gasoline in many important respects. The antiknock properties of bottled gases are superior to those of gasoline, there is less wear on a motor operating on gas, and the exhaust is less smoky and poisonous.

The existence of huge resources of all types of bottled gases, as well as the high qualities of these gases as motor fuel, create the most favorable conditions for the development of automobile transport operating on bottled gas.

The basic types of bottled gases which should be used as automobile fuel are natural gas, coke gas, and liquefied gas.

Along with these more widespread types of bottled gases, dry petroleum gases (oil field gases and gases from petroleum-processing plants), gas from nitrate fertilizer production, purified sewer gas, and several others can also be used.

Natural gas is the most profitable and least expensive type of gas fuel. According to the Five-Year Plan, 8.4 billion cubic meters of natural gas are to be produced in 1950. One billion cubic meters of natural gas are sufficient for the conversion of 100,000 automobiles to gas /fuel/.

In the production of one ton of coke, up to 400 cubic meters of coke gas are liberated. In quality (for the most part, in calorific value), coke gas is considerably inferior to natural gas. The importance of the utilization of coke gas for automobile transport is that it is a local fuel for such industrial centers as the Urals, Donets Basin, Kuznetsk Basin and others.

Liquefied gases are by-products in the processing of petroleum, fat petroleum gas, and coal. The industrial yield of liquefied gases is from 8 to 15 percent of that of gasoline. To recover liquefied gases, it is sufficient to install a simple settling apparatus in enterprises producing gasoline. Thus, by using liquefied gases, it is possible to expand fuel resources without additional expenditures of raw materials. Unfortunately, the recovery and utilization of liquefied gases in a majority of the enterprises of the petroleum industry is completely insufficient.

The high performances of automobiles operating on bottled gas has been confirmed by the experience in operation of thousands of these automobiles in various parts of the USSR.

In the USSR the basic method of converting automobile transport to gas is the production of automobiles /designed to/ operate on bottled gas. Part of the existing inventory will also be re-equipped by installing gas installations on the sopt. However, this latter method should assume secondary importance.

The USSR automobile industry has already begun industrial production of the ZIS-156 bottled-gas-powered automobile (on the base of the ZIS-150) and the bottled-gas-powered GAZ-51-E (on the base of the GAZ-51), which operate on compressed gases. However, in transferring to mass introduction of automobiles operating on bottled gas, it is necessary to expand their production and to improve their technical characteristics.

At present the engines of automobiles operating on bottled gas have the same compression ratio as gasoline engines. The high antiknock properties of the bottled gases permit a considerable increase in the compression ratio and at the same time an improvement of the traction and economical characteristics of the automobile. Increasing the compression ratio does not permit the engine to be reconverted from gas to gasoline without some modifications. However, with the mass use of automobile transport powered by bottled gas and with a well-organized gas supply system, this consideration is not important.

The economizer device should be introduced widely into the manufacturing of gas equipment. Numerous tests have shown that an economizer device has a considerably greater effect when used with an engine operating on gas than when used with a gasoline engine. The use of gas cylinders made out of light alloys also considerably improves the operating qualities of automobiles operating on bottled gas.

A most important task for guaranteeing the development of gas-powered automobile transport is the construction of a network of gas service stations.

METHODS OF DEVELOPING GAS AUTOMOBILE TRANSPORT

K. Genkin

The effectiveness of the utilization of light fuels, including bottled gases, in engines with spark ignition is determined basically by the gases' antiknock properties. The octance number of gases is 90-120, while that of automobile gasoline is 65-70.

The basic disadvantage of compressed gases is that they must be under high pressure so that a sufficient supply of fuel can be carried on the automobile. Therefore, several cylinders containing fuel under pressure of 200 atmospheres [sic] must be installed on the automobile, which increase the deadweight of the automobile.

Another drawback of compressed gases is that the calorific value of the working mixture, being lower than that of gasoline, reduces the maximum power of the engine by 10-12 percent.

These shortcomings are present only in compressed gases, and are absent in liquefied gases.

The better the sulphurous, resinous, and other substances are cleaned from the gas the better the performance of a gas-powered automobile.

The most widely distributed type of gas-powered automobile at present is the so-called universal gas-gasoline automobile, which differs from the usual gasoline-burning automobile only in that it has additional gas installation. The gas is fed into the carburetor through a tube placed alongside the gasoline jet tubes. Such an automobile retains the ability to operate on gasoline; however, its performance when operating on gas is considerably lower than the optimum.

When a gasoline engine is transferred to gas without modification, its power is reduced as a result of the lower calorific value of the working gas-air mixture, and also as a result of the failure to exploit the possibility of increasing the compression ratio. The charging is inferior because of the unnecessary superheating of the gas working mixture (when there are unseparated intake and exhaust manifolds), and the hydraulic resistances increase because of the presence of the combined carburetor-mixer.

With compressed gases having an average calorific value, the drop in power reaches 18-20 percent and noticeably affects the traction and dynamic qualities of the automobile.

When an engine is transferred from gasoline to gas, its average operational economy is reduced by 10-20 percent for compressed gases and by 10-15 percent for liquefied gases. The basic reason for this reduction is usually the absence of an economizer device, a compensating air valve, and other equipment when operating on gas.

The high antiknock properties of bottled gas permit an increase in the compression ratio, the most effective means of simultaneously increasing the economy and the power of the engine.

For compressed gases it is possible to increase the compression ratio to 10-12: 1, and for liquefied gases, to 8-9: 1.

To increase the power of the engine by improving the charging of the cylinders with mixture and the mixture formation, the intake and exhaust manifolds should be separated (or isolated from each other) and a special gas mixer should be used. When all these possibilities are employed, the performance of the engine is improved considerably. However, the deficient mechanical durability in existing gasoline engines hinders the use of the most efficient maximum compression ratio.

The compression ratio of a gasoline engine, when the engine is transferred to gas, can be raised by 2-2.5 units without appreciably impairing the durability of the crank drive mechanism or the flow of mixture through the valves.

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Thus, by introducing several changes into the gasoline engine -- replacing the head, separating the exhaust and intake manifolds, and installing a gas mixer in place of a carburetor -- a gas engine can be obtained which is considerably superior in performance to the universal gas-gasoline engine.

The power of such an engine when used with coke gas is 3-5 percent greater than when using gasoline. When using highly calorific methane gases and compressed gases, the increase in power reaches 10-20 percent.

Operating expenditure of gas after these changes have been made in the engine is reduced by 20-30 percent, in comparison with the expenditure of gas in a gasoline engine which has not been modified.

The engine can be equipped to run for a short time or to start on gasoline by installing a carburetor with a diffuser with a small cross section in order to avoid backfiring when the throttle is wide-open.

The most important item for the gas installation is the cylinder for compressed gases. Gas-powered automobiles operating on compressed gases have received a basis for development only because of the appearance in 1934-36 of steel cylinders containing fuel under a working pressure of 200 atmospheres. However, the great weight of the fuel containers remains the basic drawback of gas-powered automobiles operating on compressed gases, and therefore the reduction of the weight of the cylinders is the most important task in the development of gas-powered automobile transport.

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